quasar is an Ohio-based renewable energy company.

- Aggregation of the best anaerobic digestion technology available
- Produce energy for use as fuel & value added products from organic residuals
- Laboratory & Engineering Facility on the OSU – OARDC campus
- Provide complete turn-key residual management solutions
- Dedicated to building systems based on US components
- More than 40 projects in our business pipeline
- Four facilities operating in Ohio and one in Massachusetts

quasar’s Mission ... “To produce affordable renewable energy from commercial, municipal and agricultural biomass, while improving the environment.”
quasar energy group:

In December 2010 quasar initiated the commissioning of its fourth Ohio facility in Columbus. Operating facilities include:

- Akron, Ohio - **Operational**
- Wooster, Ohio /OSU-OARDC – **Operational**
- Zanesville, Ohio – **Operational**
- Columbus, Ohio – **Operational**
- Rutland, Massachusetts – **Operational**

Producing more than 3MWh 24 hours/day

**quasar’s operating facilities are exceeding design capacity by approximately 30% . . .**
Anaerobic digestion is a natural process where microorganisms break down organic biomass in the absence of oxygen.

**Inputs**
- Agricultural Biomass (manure, crop residuals, energy crops)
- Food Processing Residuals & FOG (fats, oils and grease)
- Municipal Wastewater (biosolids)

**Products**
- Renewable Energy – Natural Gas, Electricity, Motor Vehicle Fuel (CNG)
- Animal Bedding, Peat Alternative, & Compost
- Concentrated fertilizer that can be removed from the watershed
- Reduced Greenhouse Gas Emissions, Cleaner Water, & Cleaner Air
WOOSTER, OH:

Placed in Service: 2010
Annual Tons: 20,000 wet tons
Generator: 600 kW
RUTLAND, MA:

Placed in Service: 2011
Annual Tons: 15,000 wet tons
Generator: 450 kW
ZANESVILLE, OH:

Placed in Service: 2010
Annual Tons: 30,000 wet tons
Generator: 1 MW
COLUMBUS, OH:

Placed in Service: 2010
Annual Tons: 50,000 wet tons
Generator: 1 MW
Must provide evidence to EPA that we are true recycling

• Regulatory agencies will not endorse or permit sham recycling.

• Feedstocks are organic based and capable of generating biogas.

• Biogas is captured and used to generate green renewable energy.

• Digested feedstocks are recycled for agronomic benefit and/or animal bedding.

• There is a notable reduction of odor through conversion of volatile solids into biogas.
• Federal Clean Water Rules and Regulations.

• Agricultural permitting is usually managed by the state department of agriculture.

• CAFO MOC and/or PTI

• Controlling erosion and sedimentation during construction is usually controlled by EPA.

• Stormwater (NOI)

• Regulatory agencies will usually assign an arbitrary cut-off point to distinguish agricultural from commercial/industrial activities.

• Limit - 25% outside feedstocks
• EPA permitting starts when the outside feedstock trigger value is reached for agricultural projects, when a project is not located on a farm, or when biosolids are included.

• Biosolids, non-CAFO setting, and/or >25% outside feedstocks at CAFO setting

• Surface Water (PTI & NPDES)

• Air (PTIO)

• Stormwater (NOI)

• Feedstock permitting may be required if state doesn’t have a pre-qualified list. Most will pull from composting rules.
• Based on Federal Clean Air Act, permitting will be similar from state to state with some states being more strict based on specific conditions.

• Expect to be required to obtain a PTIO. If you don’t regularly submit such applications seek out a qualified consultant.

• General permit for digesters is in progress in Ohio. Once regulators process several permit applications they realize that there is adequate commonality in applications to go with a general permit.

• Agricultural settings are regulated less intensely than commercial, industrial, and municipal settings.

• There is an informal exemption for agricultural digesters currently in Ohio.
• The feedstocks going into digesters can be classified as solid waste.

• Unless the EPA has gone through the process of defining acceptable feedstocks for composting they may not have a frame of reference for beneficial use of organic feedstocks.

• Deciding which regulatory program a digester fits into will result in efforts to make your digester fit into existing regulatory framework. It took effort in Ohio to convince EPA not to regulate anaerobic digesters as waste to energy facilities.

• The EPA finalized backing away from regulating digesters as energy facilities after USEPA action not to regulate on 2/25/11.
• Some states have rules for vegetative foodwastes that are different than those for meat/dairy/FOG wastes.

• Many times regulators don’t know how to fit digesters into their regulatory formats. Some states are using compost rules as basis for digester foodwaste feedstocks.

• Operationally we have seen dramatic differences in foodwaste inflows on a source specific and foodwaste type on a daily/seasonal and clean-out/shut-down basis.

• Source separation is the key to successfully accepting foodwastes for beneficial use.
• Carbon and nutrients from a food waste will produce biogas just as readily as wastes from alcohol based personal care products.

• We are working on ways to accept non-food waste, organic based, biogas producing feedstocks.

• Lab testing has shown that many personal care products can be used to generate high quality biogas without impacting digester biology.

• Be aware of unique DOT labeling and/or transportation requirements. Ask yourself if you are equipped to manage feedstocks that may have a low flashpoint or want placarded trucks with haz-mat licensed drivers coming to the digester.
OPTIONS FOR Utilizing the digested product

- Digested feedstocks are recycled for agronomic benefit. With the odor reduction provided by digestion neighbors are more accepting of expanded livestock operations.

- Dewatered digested feedstocks are used for animal bedding.

- Sawdust and similar materials become quite expensive as energy costs go up.

- Dewatered digested manure is a peat moss substitute that is renewable and non-destructive to the environment.

- Nutrients can be recovered from the digested feedstocks and removed from impacted watersheds as products.
BIOGAS CLEANING and utilization options:

- Biological H₂S removal in gas domes.
- Cleaning and separation technologies.
- On-site electrical generation
- On-site compression for CNG
- On-site boiler fuel, or cleaned to natural gas standards and put into natural gas distribution pipeline.
Which types of biomass are best for a digester?

Biomass recipes will differ based on the type and quantity of feedstock available in the region. quasar’s laboratory on the OSU/OARDC campus validates biomass recipes to guarantee a system’s energy potential for our customers.
Ohio is an excellent untapped resource for food waste.
COMPONENTS

Flare

Membrane

Mixers & Stands

Live Bottom Hopper

Heat Exchanger

designed by quasar - made in Ohio
quasar is working with more than 50 Ohio contractors, suppliers, manufacturers and fabricators to source components and labor for our facilities.

- In 2006, components for AD systems were primarily sourced in Europe.
- Over the past 4 years, quasar has worked with U.S. and specifically Ohio vendors to source major components.
- NOW, more than 90% of our components are sourced in the U.S. and more than 50% of those are from Ohio based companies!
**POTENTIAL ENERGY**

Evaluating the biomass potential

Quasar has developed a national renewable energy potential database based on a study performed at The Ohio State University. The database projects the amount of available biomass by state, the number of viable digester projects, and the amount of energy that can be produced.

**POTENTIAL ENERGY: EXAMPLE - OHIO**

<table>
<thead>
<tr>
<th>Potential Digester Information</th>
<th>Annual Generation in $ Billions</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Cap. X $ Billions</td>
</tr>
<tr>
<td>Digesters</td>
<td></td>
</tr>
<tr>
<td># Jobs Created</td>
<td></td>
</tr>
<tr>
<td>Cap. X $ Billions</td>
<td></td>
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<tr>
<td>Total</td>
<td></td>
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</tbody>
</table>

Based on 2011 economic incentives and existing market driven energy and biomass management practices, the total capital investment in Ohio to manage the illustrated biomass is $10.2 billion.
Operational Facilities:
- Akron, OH
- Columbus, OH
- Wooster, OH
- Zanesville, OH
- Rutland, MA

Coming in 2011:
- French Creek
- Celina, OH
- Cincinnati, OH
- Cleveland, OH
- Columbus, OH
- Haviland, OH
- North Ridgeville, OH
- Uniontown, OH
- Wooster, OH
- Zanesville iADs, OH

Offices:
- Headquarters
  Cleveland, OH
- Engineering
  Wooster, OH
- Laboratory
  Wooster, OH
Growing a bioenergy industry means growing the demand for educated, experienced technicians.

**Direct Jobs:**
- Civil Engineering
- Mechanical Engineering
- Electrical Engineering
- Construction Management
- Plant Operators
- Biological Analysis
- Regulatory Compliance
- Agronomy
- Wastewater Specialists
- Accounting
- Project Finance
- Biogas Specialists

**Indirect Jobs:**
- Agriculture
- Engineering
- Soil Analysis
- Environmental Analysis
- Biomass Transportation
- Component Design
- Component Fabrication
- Component Supply
- System Construction
- Legal – Advanced Energy
- Waste Management
- Manufacture of CNG Vehicles
- Design and construction of CNG/ LNG fueling systems

Developing a curriculum with OSU - ATI
The future is renewable fuel

Quasar is integrating CNG fueling stations into our anaerobic digestion facilities to service public and private fleets, and small vehicles.

- Quasar plans to replicate the anaerobic digester success story by sourcing fueling station components in Ohio.
- Ohio can lead the way in conversion of vehicles to CNG fuel. The time is NOW.